

WHAT IS CLAIMED IS:

- 1 1. A hydraulically settable lightweight concrete composition
2 which cures to a cured composite following addition of water and exhibits strain
3 hardening behavior following cure, said composition comprising
 - 4 a) a brittle inorganic matrix precursor;
 - 5 b) reinforcing fibers having a minimum average length of about
6 4 mm, present in an amount of from 0.5 volume percent to
7 less than 4 volume percent based on the total volume of cured
8 composite;
 - 9 c) at least one lightweight aggregate having a mean particle size
10 in the range of 10 μm to 1000 μm , in an amount effective to
11 achieve a target density in said cured composite below about
12 2000 kg/m^3 .
- 1 2. The composition of claim 1, wherein said reinforcing fibers
2 comprise polymeric reinforcing fibers having a mean diameter from 10 to 60 μm ,
3 a mean length of 4 mm to 30 mm, a strength of 800 MPa or higher, a modulus of
4 elasticity of 10 to 300 GPa, interfacial chemical bonding below 4.0 J/ m^2 , interface
5 frictional stress from 0.5 to 3.0 MPa, and an interface slip hardening coefficient
6 below 3.0.
- 1 3. The composition of claim 1, wherein said lightweight
2 aggregate comprises microballoons having a mean diameter of from 10 μm to 100
3 μm .
- 4 4. The composition of claim 3, wherein said microballoons have
5 walls of glass, ceramic, or polymer.
- 1 5. The composition of claim 1, wherein said brittle inorganic
2 matrix precursor comprises a hydraulically settable cement or an inorganic polymer.

1 6. The composition of claim 1, wherein said brittle inorganic
2 matrix precursor comprises a Portland cement.

1 7. The composition of claim 1, comprising, for each one part by
2 weight of cement, from 1.0 to 3.0 volume part reinforcing organic fibers and
3 sufficient lightweight aggregate to achieve a density, when cured by addition of
4 water, of from 800 kg/m³ to 1900 kg/m³.

1 8. The composition of claim 1, wherein said reinforcing fibers
2 are selected from the group consisting of high density polyethylene fibers, polyvinyl
3 alcohol fibers, and polyarylamide fibers.

1 9. The composition of claim 1, wherein said fibers contain polar
2 or hydrophilic groups.

1 10. The composition of claim 1, wherein at least a portion of said
2 lightweight aggregate comprises gas filled voids.

1 11. The composition of claim 1, wherein gas filled voids are
2 present, and a cured composite achieved by adding water and curing, has a density
3 of from 1500 kg/m³ to 1900 kg/m³.

1 12. A fiber reinforced lightweight concrete structure, comprising
2 a cured, fiber reinforced brittle matrix composite prepared by adding water to the
3 composition of claim 1 to form a hydraulically curable composition, and allowing
4 said curable composition to cure.

1 13. The composite of claim 9 which has a density in the range of
2 800 to 2000 kg/m³ and exhibits a tensile strain of 2% or greater.

1 14. The composite of claim 9 which has a density in the range of
2 900 kg/m³ to 1600 kg/m³ and a tensile strain capacity greater than 3.0%.